Inter-institutional and Intergovernmental Arrangements: MIDAS and the Caribbean Tsunami Warning System

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Geophysical Hazards and Plate Boundary Processes in Central America, Mexico and the Caribbean

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Indeed the January 12, 2010 and the tragedy of our Haitian brothers and sisters was a grim reminder to us all that much more effort is needed to construct earthquake resilient societies, protecting lives, property and livelihood throughout our region, and the challenge this poses to seismic networks and institutions…

Challenges and Issues

- Seismic networks play a critical role in being the seismic conscience of a country. Seismic networks are the local champions for seismic risk reduction. Span the terms of office of our political leaders…
- The best service is that which can be provided the closest possible to its customers, nevertheless, not all nations, countries, commonwealths and territories in the Caribbean and Adjacent regions (of which there are 43) have a 24 x 7 capability to acquire and analyze seismic, sea level and other data to generate timely and possibly life critical products on earthquakes and tsunamis, but all can have a capability to receive and disseminate these products.
- For a tsunami warning system, an early earthquake warning system, the interaction between the service provider and the decision maker in each of the 43 jurisdictions is very important before, during and after a tsunami event.
- Capacity building is critical whether for the operation, management and usage of seismic data. Meetings and workshops are great for building the human network (trust among networks) and also exposing operators to emerging technologies, opportunities and research. Academic training is key to integrating these into operations.
- The engagement with the media is key as they are our bridge to the decision makers and the general public.
- Research provides credibility to our operations, as well as the foundation for DRR.

MIDAS: International Inter-institutional Arrangement

- Consortium established 20 years ago in 1990
- Gerardo Suarez (UNAM), Carlos Mendoza (USGS), Federico Guendell (OVSICORI), Eduardo Camacho (UPA), Margaret Wiggins (EU), David Novello (UNAM), Gustavo Malave (FUNVISIS), Michael Schmitz (FUNVISIS), Bruce Presgrave (USGS)…
- Situation: Outside of the handful of GSN stations, there were no locally operated broad band stations, no/limited exchange of data information between seismic networks and a need for capacity building and strengthening seismic research
- Objectives:
  - Promote the advancement of broadband instrumentation
  - Coordinate the exchange of earthquake information, phase data, full-waveform data
  - Increase technical and scientific capabilities
  - Provide a forum for scientific research

MIDAS Accomplishments

- Signatories: ISU (Dom. Republic), CASC, INDRHI (Dom. Republic), UNAH, CENAIS (Cuba), FUNVISIS, FUNISA, NEIC, OVSICORI, IG-UNAM, INETER, SRU, EU (Jamaica), PRSN, INGEOMINAS,CICESE.
- Held meetings (Puerto Rico, Jamaica, Florida)
- Installed the TEIG and UPA broad band stations in Yucatan and Panama
- Published the seismicity map of the MIDAS region
- Established a website with an online catalogue of earthquake locations
- **Most important of all: Created a network of operators of seismic stations throughout the Caribbean**

Other Accomplishments…

- Digital data acquisition and processing at all networks.
- It can take a minute or two to locate an earthquake
- There are almost 100 permanent broadband stations in the region…
- Almost every network has a platform for real time data exchange.
- Many earthquake professionals in the region, and colleagues outside of our region seeking collaboration.
- Exciting research…

Challenges for MIDAS

Networks and Research advanced, MIDAS fizzled

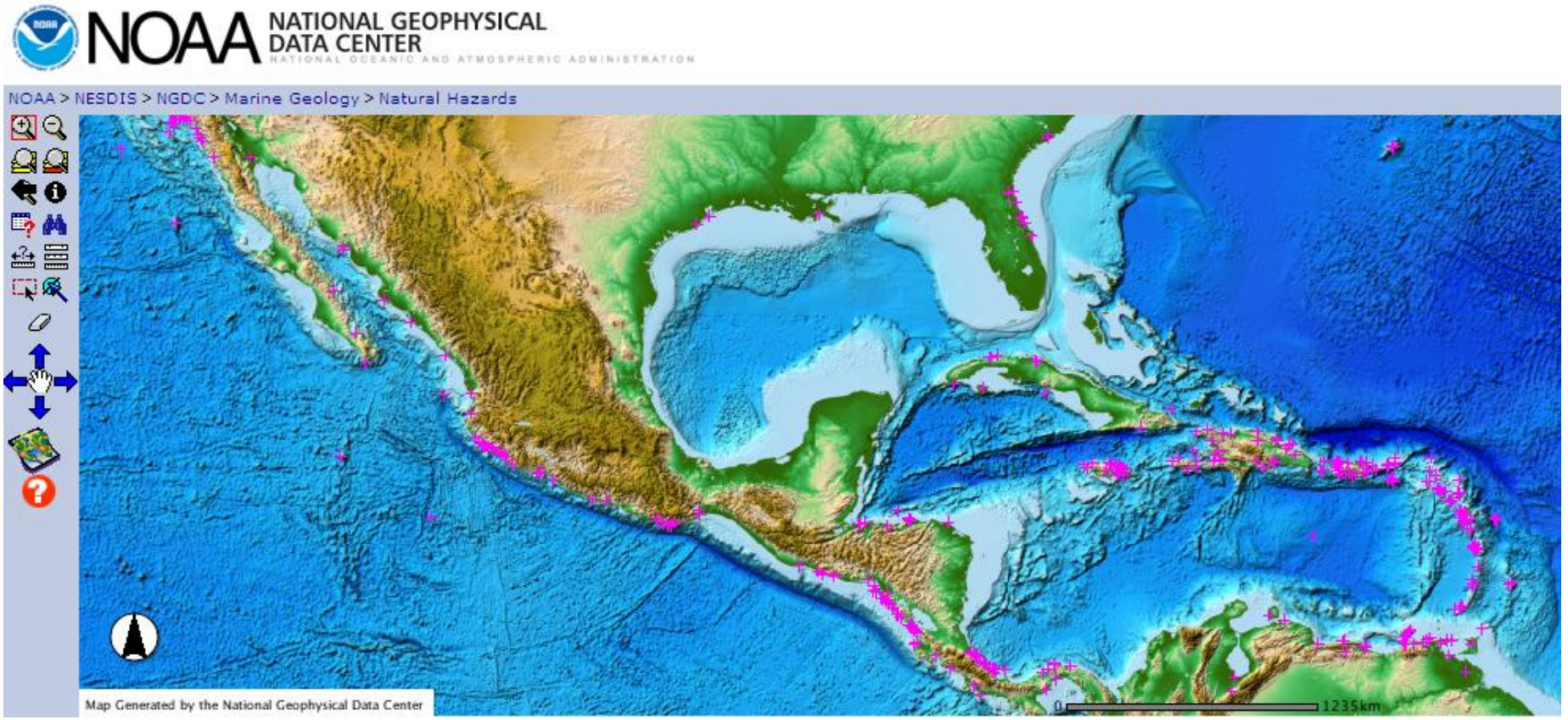
- No or extremely little funding, not that we did not try…
- Commitments made at workshops and meetings that were not kept ("synchronization in asynchronization" or "not know where we should have put the fences")
- Priorities and focus of energy of members were on the advancement (survival) of local seismic network operations, not on regional efforts
- No operational pressure, enforced deliverables (eg. from a grant), just good will…
- No governmental commitment/engagement to the Consortium
- New projects (eg. Caribbean Tsunami Warning System) arose that to a degree replaced MIDAS

Tsunami INDONESIA, December 26, 2004, Mw 9.3

UNESCO IOC Intergovernmental Coordination Group for Tsunamis and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions
CARIBE EWS

The intergovernmental response established in 2006…

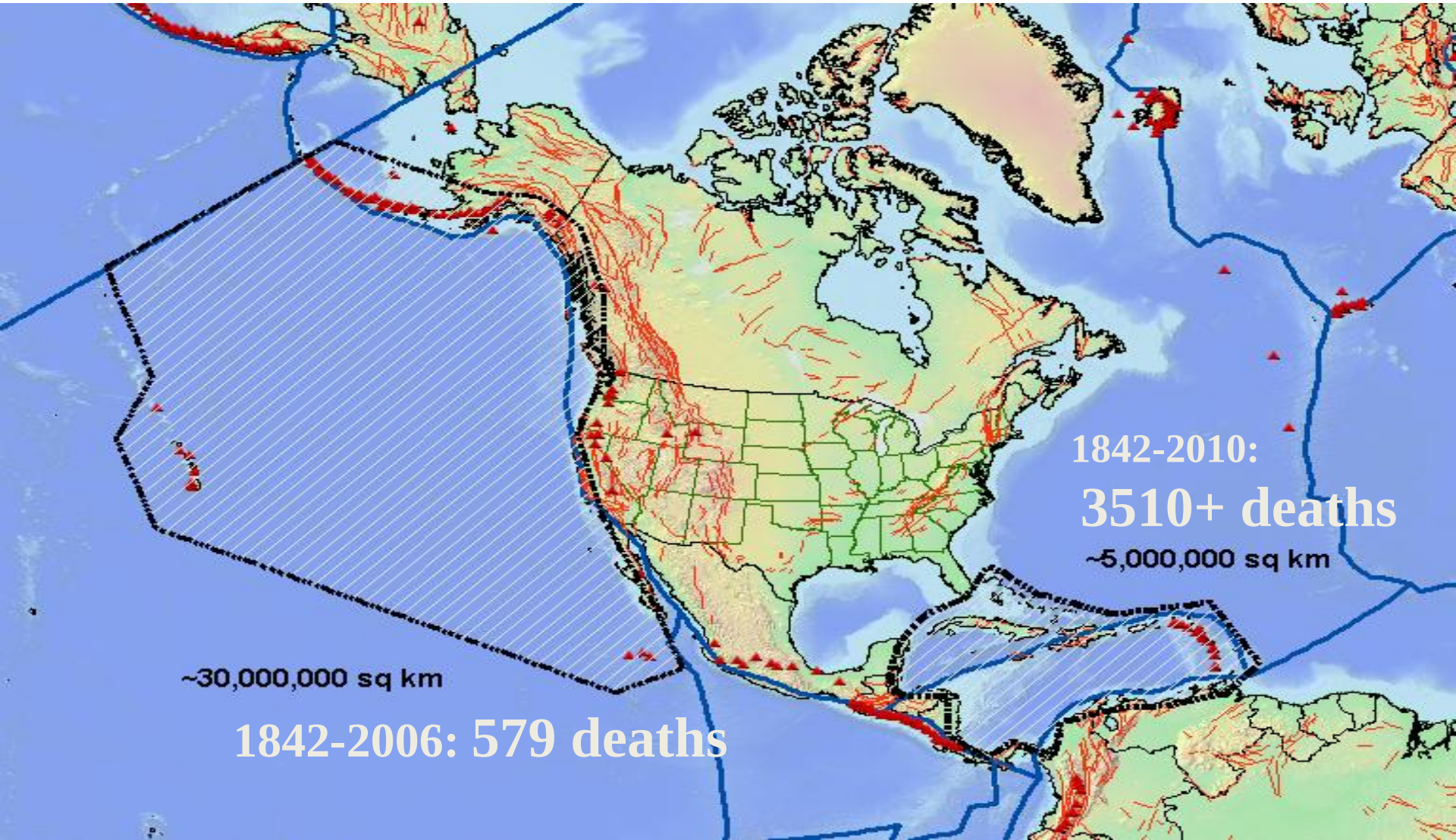
Historical Tsunami Runups in the Caribbean



40 definite tsunamis, 10 probable tsunamis, 33 questionable tsunamis, 14 very doubtful tsunamis and 1seiche.

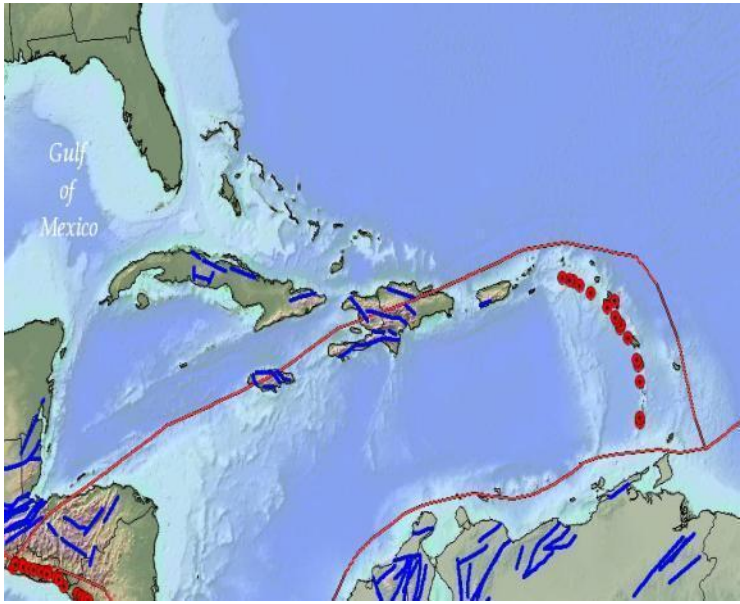
Since 1842, at least 3510 people have lost their lives to tsunamis, this is more than in the Northeastern Pacific…

<u>The Caribbean basin in only 1/5 the area had nearly 6x more deaths !</u>



The Caribbean Situation

- **Last major tsunami event(s): Dominican Republic: 1790 +75 = 1865* deaths in August, 1946.**
- **Since 1946, explosive population growth across Caribbean from residents and tourists at the coasts**
- **Therefore, the Caribbean's historical deaths from tsunamis greatly understates its current 21st century potential loss of life!**
- **If we just take into consideration the number of people that can be on the beach, 50,000 people are exposed daily to tsunamis in the region.**



The Basin has many tsunami-genic areas: tectonic zones & faults, shelves-trenches, volcanoes

*Statistics from ***Caribbean Tsunamis, A 500-Year History from 1498-1998***
by Karen Fay O'Loughlin and James F. Lander
(ISBN 1-4020-1717-0 2003 edition)

Main Components of CARIBE EWS

Per recommendation of the Member States

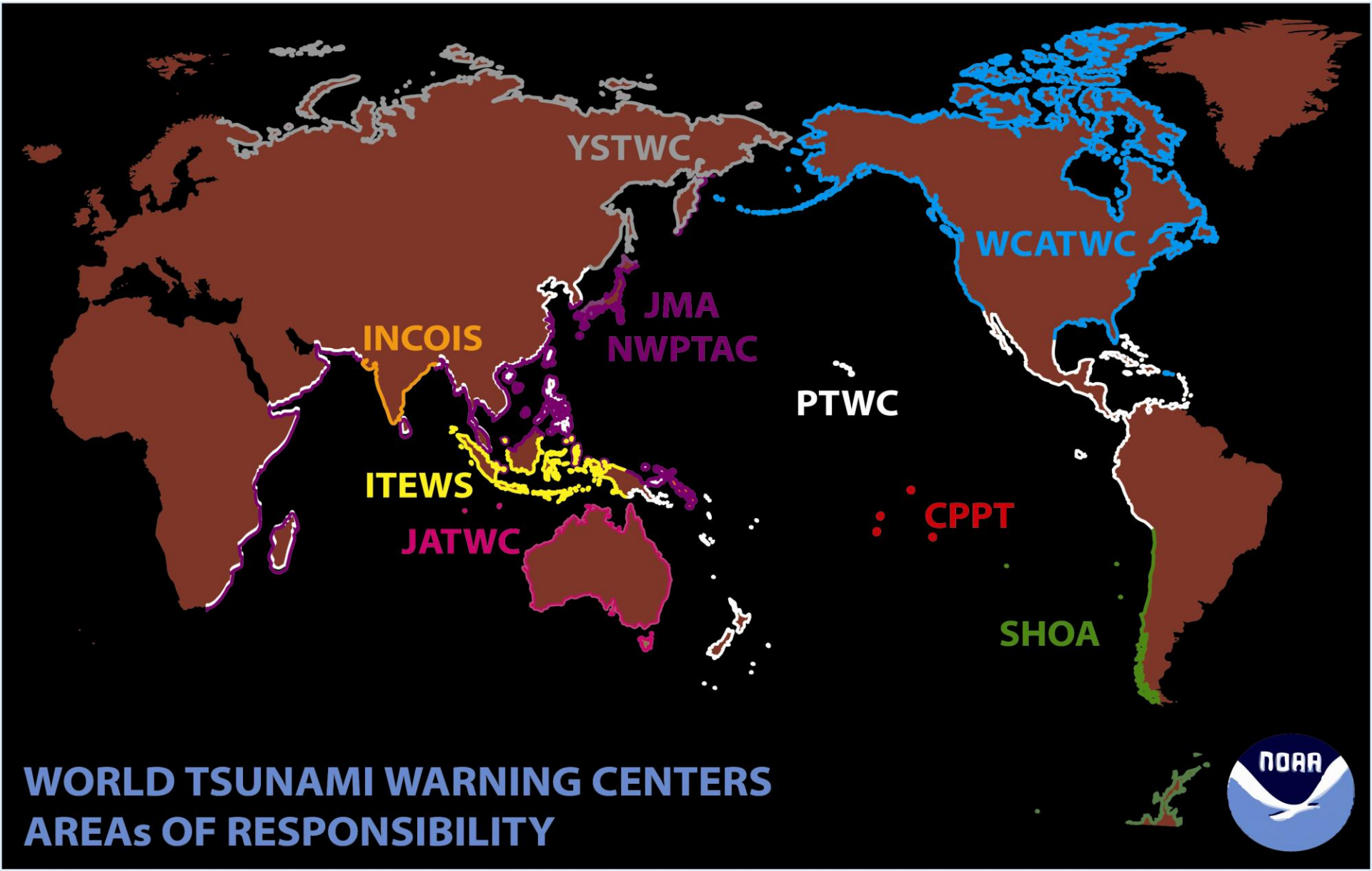
- Working Groups:
  - Monitoring and Tsunami Warning Guidance
  - Tsunami Hazard, Risk and Vulnerability Assessments
  - Communications
  - Preparedness, Readiness and Resilience

- Permanent Bodies
  - Caribbean Tsunami Warning Center-CTWP potential first step
  - Caribbean Tsunami Information Center – to be established in Barbados with funding by the Govt. of Italy
  - Secretariat-Interim location in Paris, France at UNESCO HQ

- National Stakeholders
  - National Tsunami Contacts
  - Tsunami Warning Focal Points

YSTWC - Yuzhno-Sakhalinsk Tsunami Warning Center
INCOIS - Indian National Centre for Ocean Information Services
ITEWS - Indonesia Tsunami Early Warning System
JATWC - Joint Austalia Tsunami Warning Centre

WCATWC - West Coast and Alaska Tsunami Warning Center
JMA NWPTAC - Japan Meteorological Agency
North West Pacific Tsunami Alert Center
PTWC - Pacific Tsunami Warning Center
CPPT - Centre Polynésien de Prévention des Tsunamis
SHOA - Servicio Hidrográfico y Oceanográfico de la Armada



WORLD TSUNAMI WARNING CENTERS
AREAs OF RESPONSIBILITY

Recommendations of ICG CARIBE EWS for Seismic Monitoring

- Establish Performance Criteria and Requirements for seismic stations
- Each Tsunami National Contact (Government official) has been requested to identify the contact point within the country for seismic, sea level and other observational data
- Develop a training plan for station operators
- Urges member states to upgrade and/or install GPS stations and consider collocation with seismic and sea level stations

Cont. Further Recommendations

- Urges Member States and other stakeholders to provide funding to support the acquisition, installation, maintenance and operation of core seismic and sea level stations contributing data to meet the full needs of the CARIBE-EWS and strengthen the communication systems of the monitoring centres exchanging data with the warning centres to ensure data availability;

Cont. Further Recommendations

- Welcomes the Memorandum of Cooperation between the CTBTO and IOC to facilitate the access of primary and secondary data to the CARIBE-EWS;
- Encourages that the continuous seismic data be sent to global data centres to facilitate research to improve the understanding of the seismic hazards;

ICG CARIBE EWS Mission statement for the Caribbean Tsunami Warning Center (CTWC)

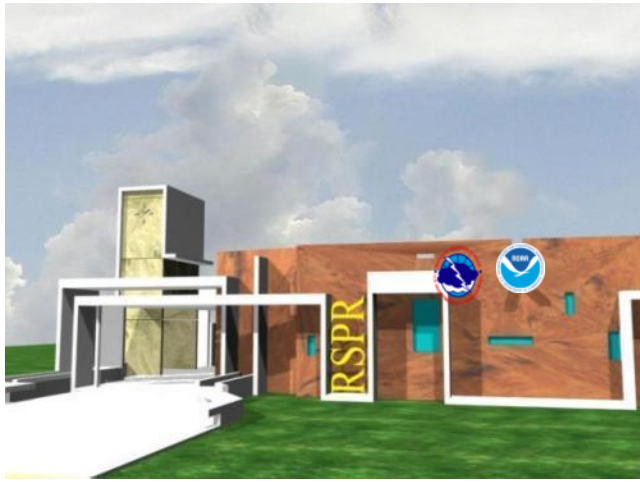
approved June, 2009

- The CTWC will provide a timely and effective **detection and analysis (forecast)** of seismic events and tsunamis, **conduct research and dissemination** of tsunami watch, warnings and advisory products, as well as provide support for **education, outreach and training** to the Caribbean countries, states, territories and Adjacent Regions.

CTWC

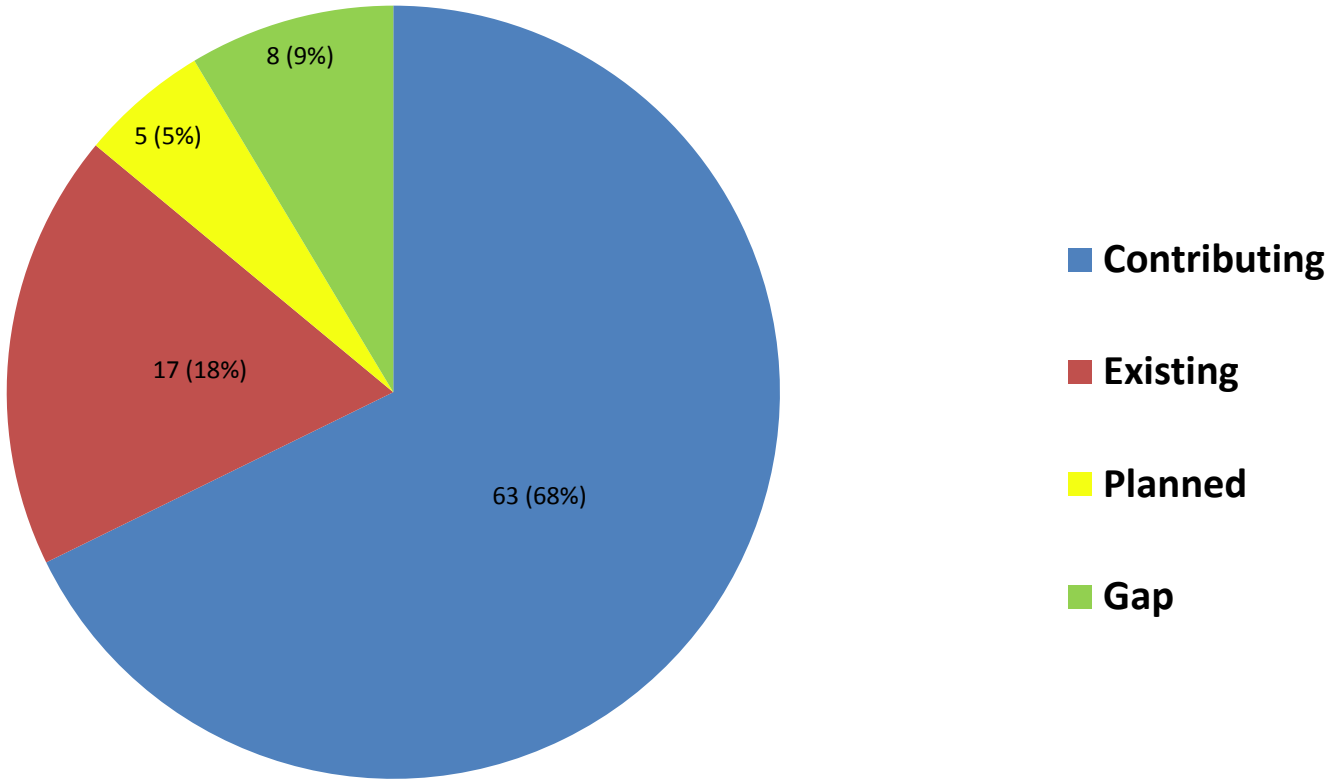
"Providing regional service, strengthening local capabilities…"

- NOAA NWS established in February 1, 2010 the **Caribbean Tsunami Warning Program**, jointly located at the Puerto Rico Seismic Network at the University of Puerto Rico at Mayagüez as a 1rst step of the U.S. towards the establishment of a Caribbean Tsunami Warning Centre.
- When will the Program become a Centre?
  - Funds are appropriated
  - Upon CARIBE EWS recommendation
- ICG VI will consider further contributions of MS to the establishment of a Regional Tsunami Warning Center

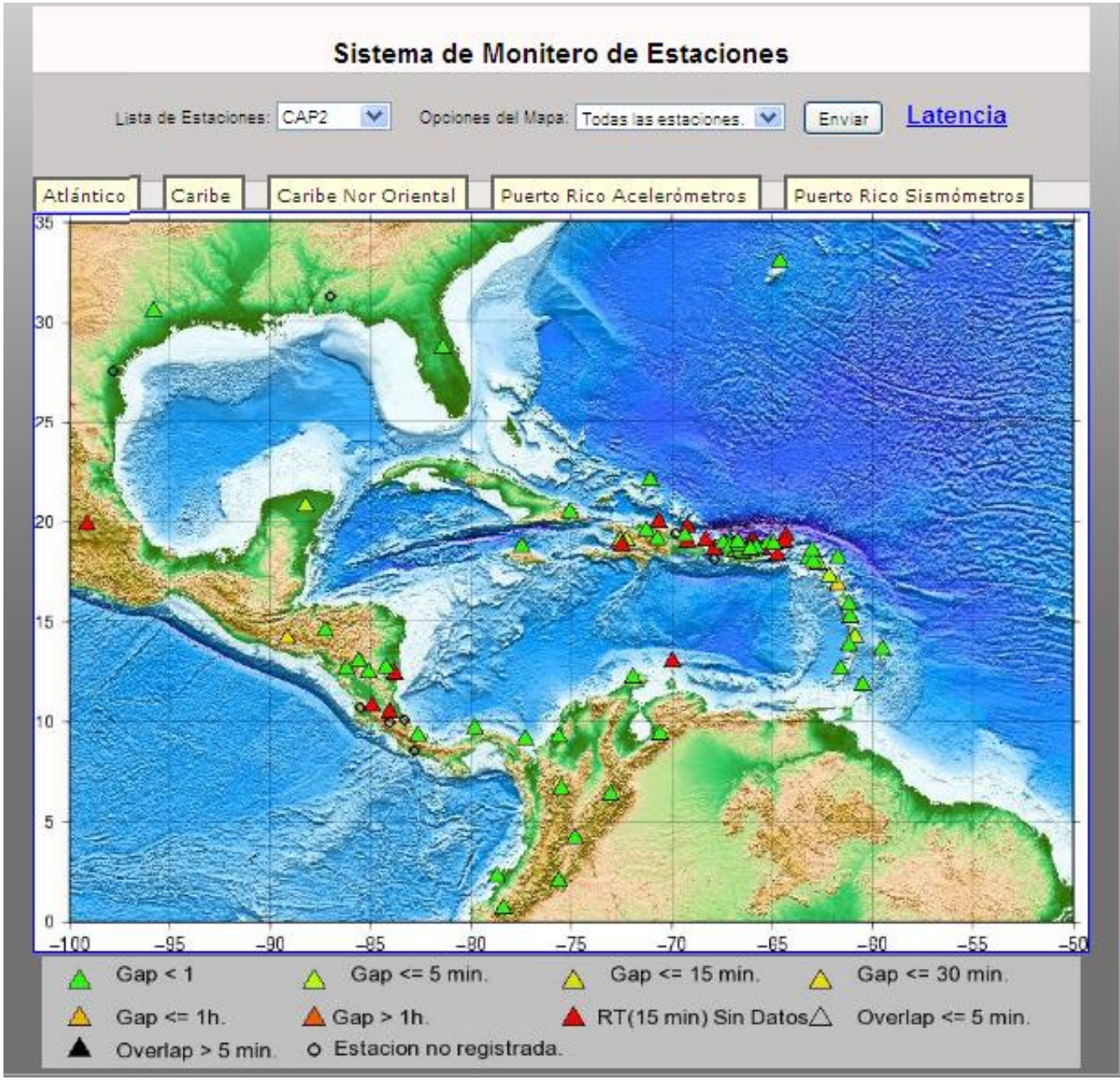


Seismic Data Availability in the Caribbean

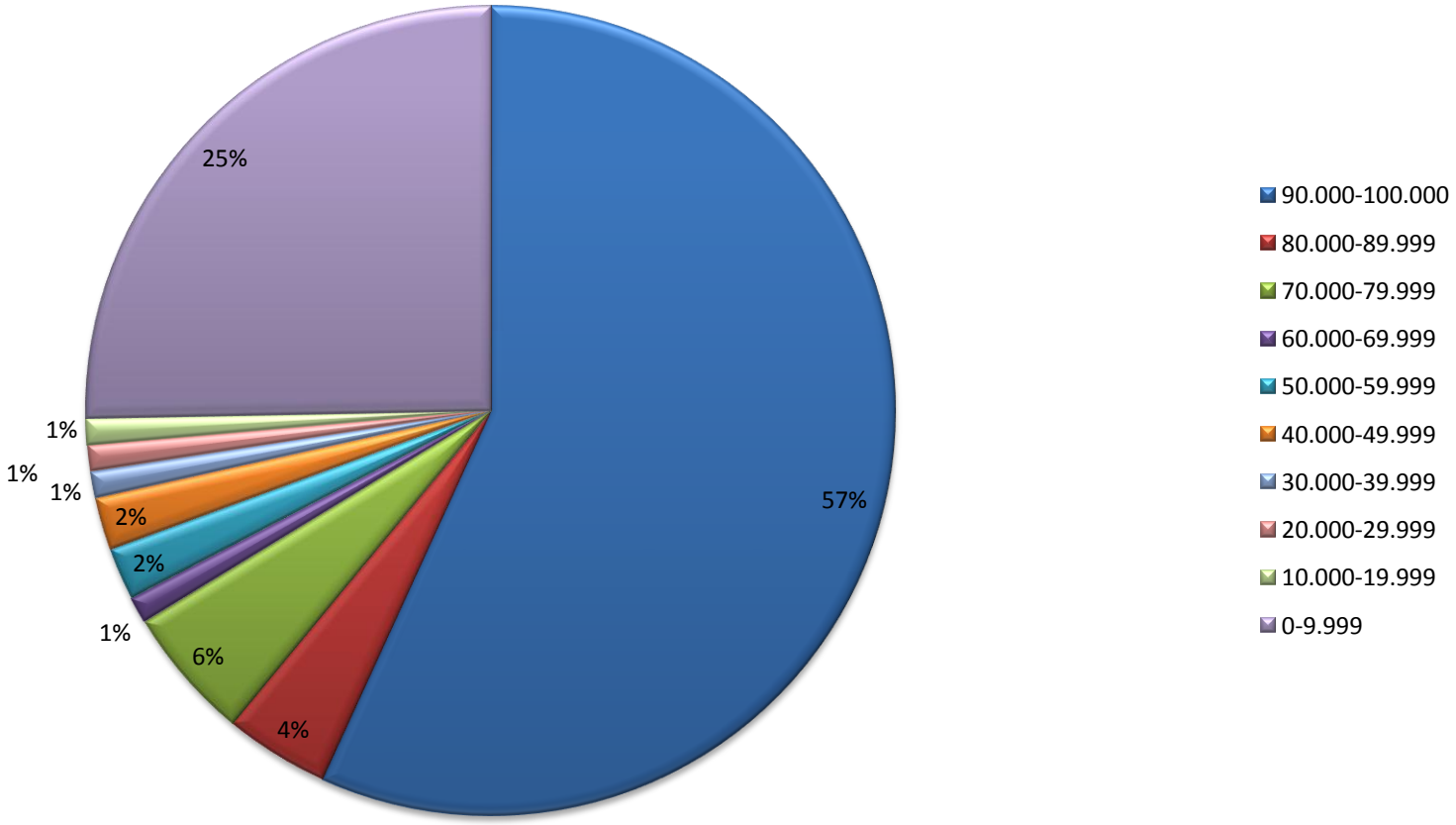
68% (63/93) of Core CARIBE EWS Stations in the Caribbean are contributing in real time. There are an additional 26 stations from the Atlantic and 7 from the Pacific



Real time seismic data availability at PRSN



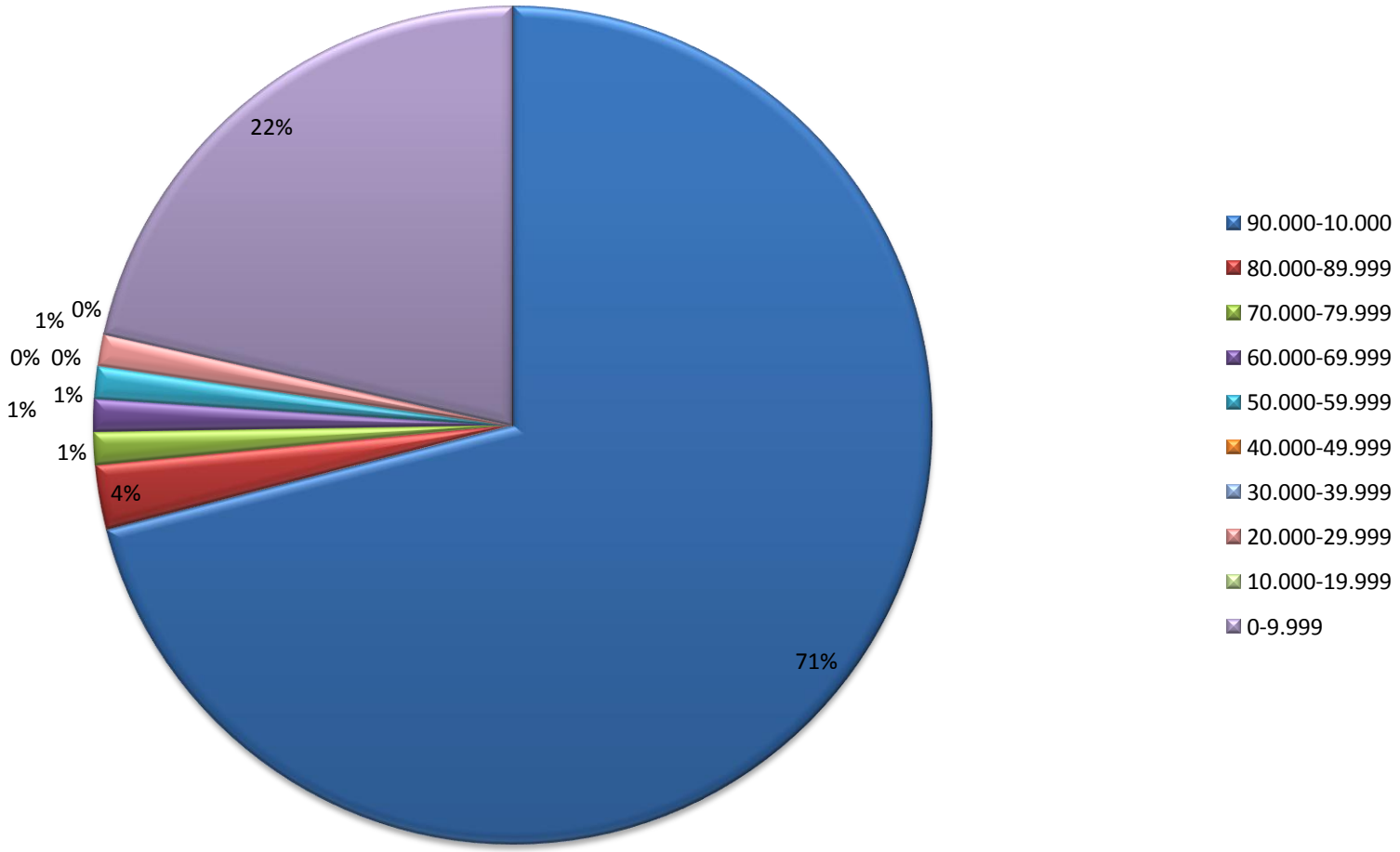
Data availability for the contributing stations at PRSN 09/01/2010-09/30/2010 (including Caribbean, Atlantic and Pacific stations).



CARIBE EWS IRIS Virtual Seismic Network

http://www.iris.edu/gmap/_CARIBE-EWS

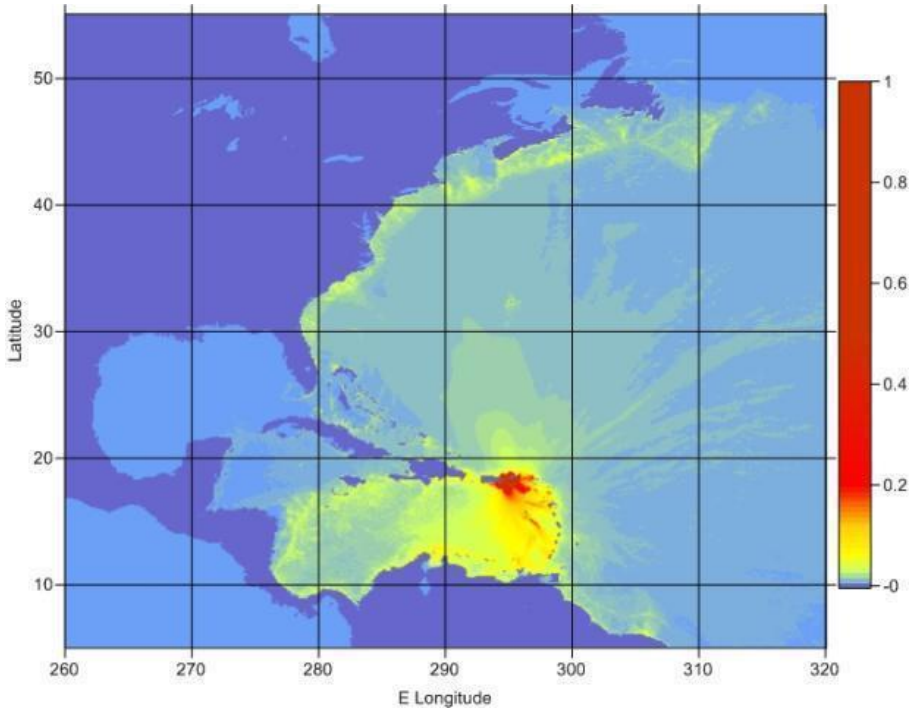
Data availability at IRIS 09/1/2010 - 09/30/2010 (including Caribbean, Atlantic and Caribbean).

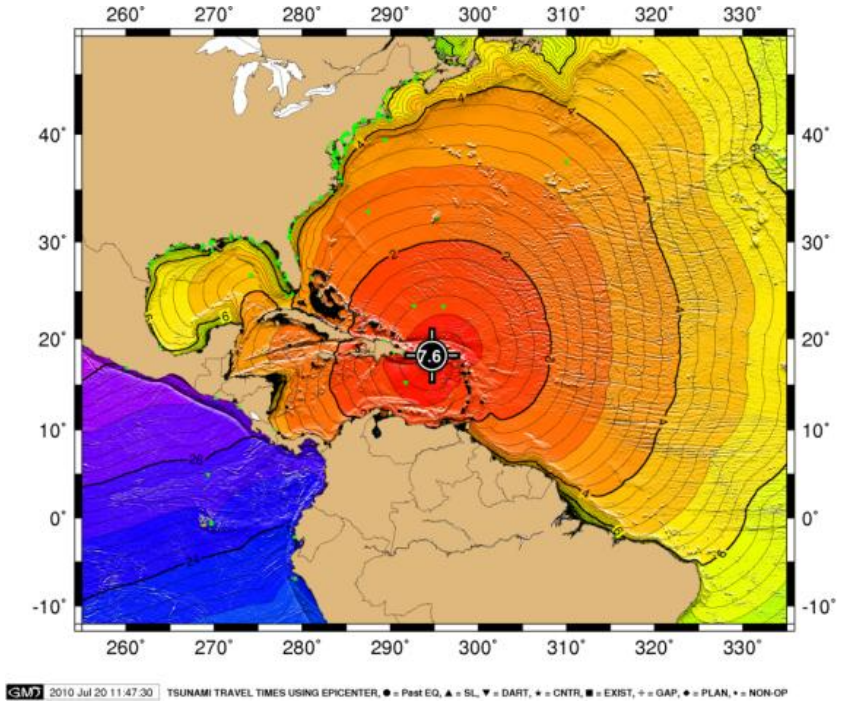


Recommendations for siting of stations focused on strategic placing Of stations on land masses, should we not be considering OBS's

CARIBE WAVE LANTEX 2011, March 23, 2011

- Tsunami generated by a magnitude @ 7.5 earthquake in the US Virgin Island Basin (similar to the 1867 VI EQ and Tsunami)





Way Forward

- New generation of operators of seismic networks and earthquake centers challenged to **keep** building/strengthen seismological collaboration and capacity.
- NOAA/NWS and ICG CARIBE EWS will be very receptive to your recommendations and strategies as you are a cornerstone to a successful tsunami warning system
- Seismological Society of America invites you to join this organization of earthquake professionals

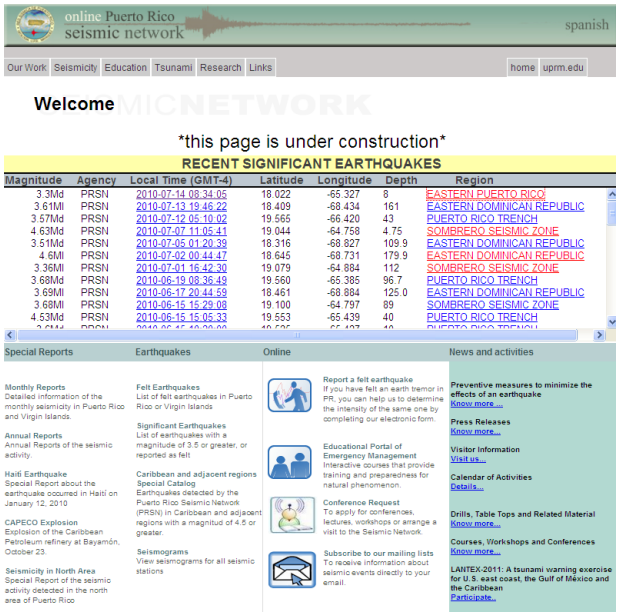
Working together to save lives, property and livelihood…

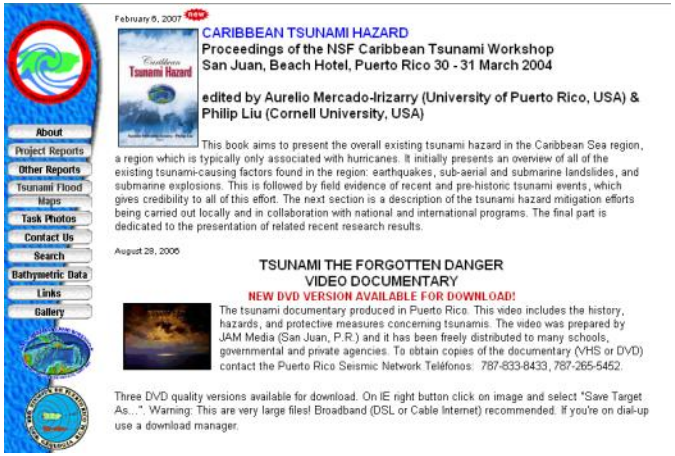
Thank you

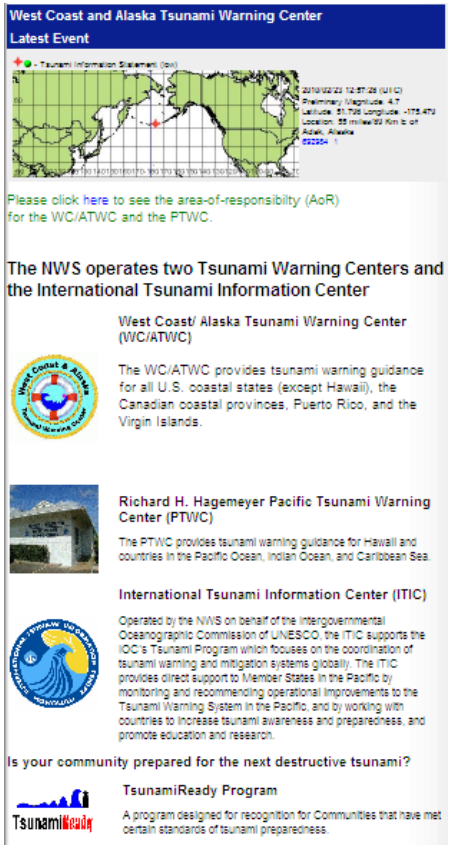
christa.vonh@noaa.gov

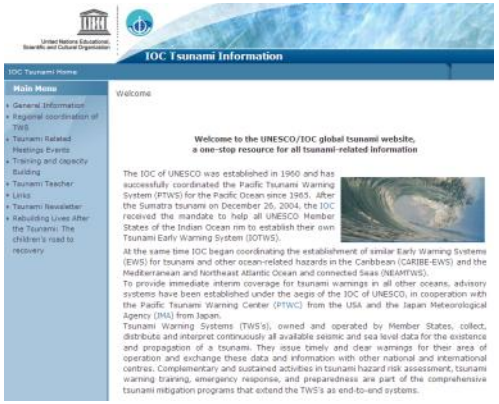
More information…

- NOAA NWS http://tsunami.gov
  - Caribbean Tsunami Warning Program, Tel. 787-833-8433, christa.vonh@noaa.gov
- Puerto Rico Seismic Network
  - http://prsn.uprm.edu
- PRTWMP with PR Tsunami Inundation Maps
  - http://poseidon.uprm.edu
- UNESCO IOC Caribe EWS http://www.ioc-tsunami.org/









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Seismic Station Requirements of ICG CARIBE EWS

approved June, 2009

CHARACTERISTICS	MINIMUM REQUIREMENTS	OPTIMAL REQUIREMENTS
Sensor type	BB Seismometer	BB Seismometer and Accelerometer
Station type	Vertical Component	Three-component each instrument
Accuracy of Location of Sensor	<100 m, horizontal < 20 m, elevation	<10 m, horizontal < 10 m, elevation
Calibration	System gain know to 10%	Full –frequency response know to 10%
Sampling rate	20 sps (seismometer)	100 sps for both instruments
Frequency Range (flat response)	0.1 to 20 sec	0.02 to 240 seconds Dc to 50 Hz
Seismometer noise	≤5 dB below the low noise model (NLNM), between 0.2 and 5 Hz	≤10 dB below the low noise model (NLNM), between 0.1 and 10 Hz
Dynamic Range	>120dB	>136dB
Absolute Timing Accuracy	<10 ms	<10 ms
Delay in Transmission to Warning Centre	<30 seconds	<10 seconds
Timely Data Availability	>95%	>95%
Data transmission protocol	Compatible with the TWC, maximum data frame length 20s	Compatible with the TWC, maximum data frame length 10s
Data transmission	Continuous	Continuous
Communications Infrastructure	Internet or VSAT	VSAT, Internet

168 Years of Caribbean Tsunami Deaths

Date	Place	Fatalities
1842	Haiti	300+
1853	Venezuela	600+
1867	Virgin Islands	23
1882	Panama	75+
1906	Jamaica	500
1918	Puerto Rico	140
1946	Dominican Republic(1)	1790
1946	Dominican Republic(2)	75
2010	Haiti	7
TOTAL		**3510**

Ref: ***Caribbean Tsunamis, A 500-Year History from 1498-1998*** by Karen Fay O'Loughlin and James F. Lander (2003: ISBN 1-4020-1717-0); Tsunamis of the Eastern US, NGDC, 2002 Science of Tsunami Hazards, vol 20, #3, pg 120; PRSN on Haiti,2010